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(54) **Chute, e.g. for use in a sorting machine**

(57) The chute (16) has an inlet portion (15) to which a plurality of objects or particles (10) may be supplied, the inlet portion (15) tapering axially towards a portion (18) whose cross-section is substantially uniform throughout its axial length, the inlet portion (15) having apertures (32) therein through which may be directed fluid jets to centralise and fluidise objects or particles (10) passing through the inlet portion (15) and thus effect substantial axial alignment thereof, and the substantially uniform cross-section portion (18) in operation accelerating these substantially axially aligned objects or particles (10) to space them from each other and thus supply them one at a time to a point of use (21).

Fig.1

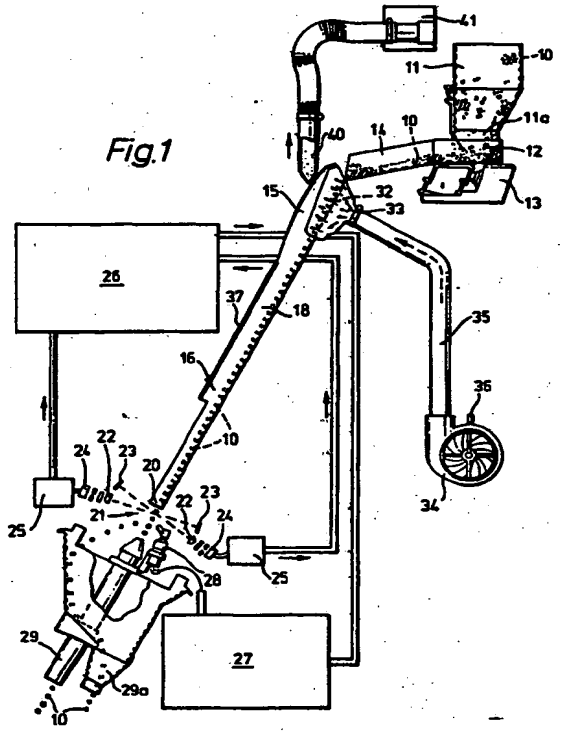

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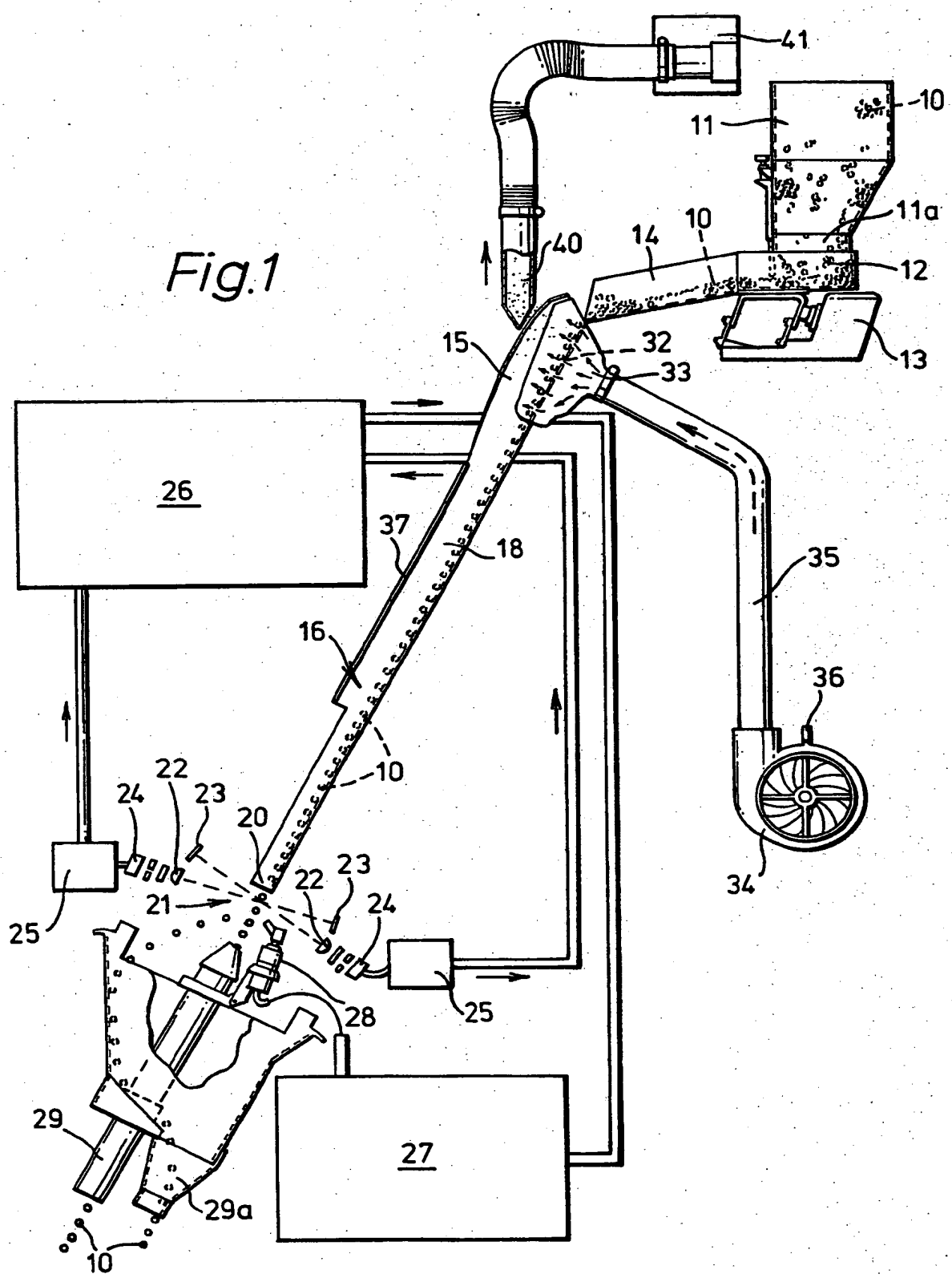
Fig.1



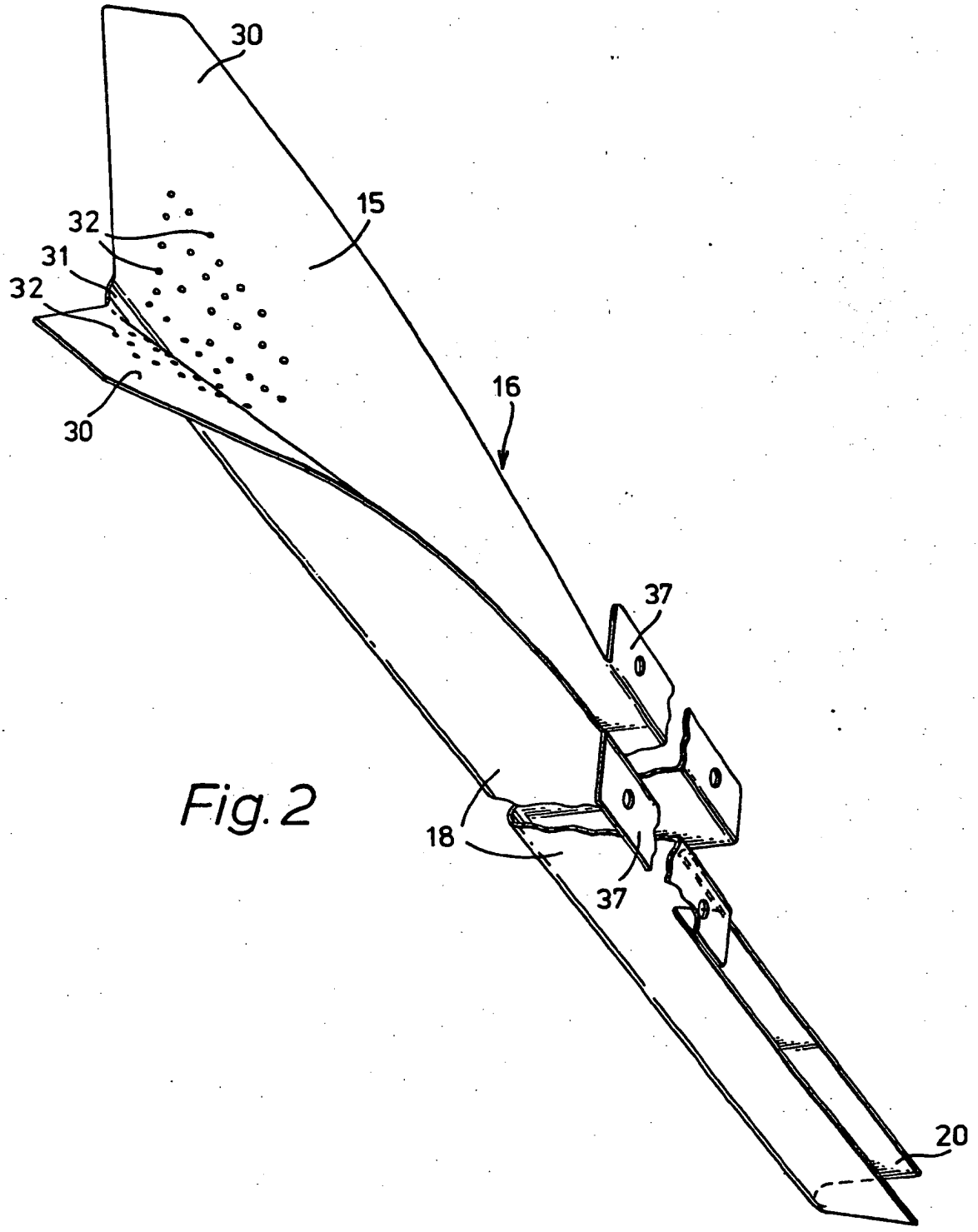


Fig. 2

SPECIFICATION

Chute, e.g. for use in a sorting machine

This invention concerns a chute and, although the invention is not so restricted, it relates more particularly to a chute for use in a light-sensitive sorting machine, and arranged between a feed member and an optical inspection member thereof.

Sorting machine chutes are commonly made of a material such as anodized aluminium whose surface needs, in operation, for many products to be treated at frequent intervals (e.g. every 30 minutes) with a silicone or other friction-reducing spray. The use of such a spray has been necessary to prevent the surface from causing rolling of a commodity (e.g. peas) passing thereover, since such rolling causes the peas to bunch together and this bunching reduces sorting efficiency because it makes it impossible to remove the defective peas without also removing large numbers of non-defective peas at the same time.

In our U.S. Patent No. 3,990,580 we have disclosed a chute for use with sultanas, the chute having apertures for the passage therethrough of air which fluidises the sultanas and thus assists their passage along the chute. This chute, however, both tapered axially and was apertured throughout its axial length, such an arrangement being necessary because of the sticky character of sultanas and their tendency to clump together.

Such tapering of a chute throughout its axial length, however, means that the chute has a funneling action throughout its axial length on the peas or other commodity and therefore means that the peas are liable to be in contact with each other at the time that they leave the lower end of the chute or, at least, may not be adequately spaced from each other. The object of the present invention therefore is to overcome this problem without the need for periodic spraying of the chute,.

According therefore to the present invention, there is provided a chute having an inlet portion to which a plurality of objects or particles may be supplied, the inlet portion tapering axially towards a portion whose cross-section is substantially uniform throughout its axial length, the inlet portion having apertures therein through which may be directed fluid jets to centralise and fluidise objects or particles passing through the inlet portion and thus effect substantial axial alignment thereof, and the substantially uniform cross-section portion in operation accelerating these substantially axially aligned objects or particles to space them from each other and thus supply them substantially one at a time to a point of use.

Thus in the case of the present invention, the funneling action of the chute is confined to its inlet portion, the provision of the substantially uniform cross-section portion accelerating the objects to effect the required spacing therebetween.

Preferably, the substantially uniform cross-section portion is unapertured or substantially unapertured.

Preferably also the substantially uniform cross-section portion extends throughout the major part of the axial length of the chute. It also preferably extends to the outlet end of the chute.

The inlet portion preferably merges into and is integral with the substantially uniform cross-section portion.

The side walls and bottom wall of the inlet portion are preferably apertured so that the air jets therethrough prevent or reduce contact between the objects or particles and said walls, the majority of the apertures preferably being in the side walls. The provision of such air jets results in much reduced wear of the said walls, whereas, in the case of anodized aluminium chutes, even the regular application of a silicone friction-reducing compound would not prevent the rapid deterioration of these walls.

The extent to which the inlet portion is apertured preferably diminishes axially towards the substantially uniform cross-section portion.

Preferably there are fluid pressure supply means for supplying said apertures with fluid pressure. Thus the fluid pressure supply means may supply said apertures with fluid pressure to produce jets whose exit velocity from the aperture is in the range 40 to 120 metres per second. Moreover, the fluid pressure supply means preferably produces jets which issue at substantially 90° to the respective walls of the inlet portion.

There may be means for maintaining the chute at an angle of at least 45° to the horizontal.

The invention is illustrated, merely by way of example, in the accompanying drawings, in which:

Figure 1 is a side elevation of a light-sensitive sorting machine provided with a chute according to the present invention, and

Figure 2 is a perspective view of the chute shown in Figure 1;

In Figure 1 there is shown a light-sensitive sorting machine comprising a hopper 11 which is adapted to be supplied with a quantity of agricultural products such as peas, peanuts, or beans 10 or with a quantity of mineral products such as pieces of ore or particulate material. For the sake of convenience such products or material will hereinafter be referred to simply as "peas 10".

The hopper 11 is provided with an outlet duct 11*a* through which the peas 10 pass to a feed tray 12 mounted on an electromagnetic or other vibrator 13. The feed tray 12 has a converging downwardly sloping outlet end portion 14 the vibration of which by the vibrator 13 accelerates the peas 10 towards an inlet or upper end portion 15 of a downwardly extending chute 16, best shown in Figure 2. The chute 16 is mounted on structure, not shown, which maintains the chute 16 at an angle of at least 45° to the horizontal.

The inlet portion tapers axially towards a main portion 18 of the chute 16 and merges into and is integral with the latter. The main portion 18 extends from the inlet portion 15 to the outlet end 20 of the chute 16, the outlet end 20 being disposed adjacent to an optical inspection area 21. As explained below, the peas 10 leave the outlet end 20 one at a time and are presented sequentially to the optical inspection area 21 where the peas 10 are viewed through lenses

22 and against backgrounds 23 by a plurality of optical light sensors 24, e.g., photocells. The light sensors 24 produce signals which are fed *via* amplifiers 25 to a comparator or control cabinet 26 where they are compared with a datum signal, the comparator 26 receiving power from a power supply 27. Thus when a discoloured pea 10 passes through the optical inspection area 21, the signals sent by the light sensors 24 to the comparator 26 are such that the comparator 26 produces an output signal which causes a pneumatic ejector 28, which is supplied with power from the power supply 27, to direct a jet of compressed air onto the discoloured pea 10. Peas which have an acceptable colour pass to an "accept" chute 29, while those which are discoloured are ejected by the ejector 28 so as to pass to a "reject" chute 29*a*

The inlet portion 15 of the chute 16 has side walls 30 (Figure 2) and a bottom wall 31 each of which has apertures 32 therein, the majority of the apertures 32 being in the side walls 30. The number of apertures 32 which are provided tranversely of the inlet portion 15 diminishes progressively towards the main portion 18 so that the extent to which the inlet portion 15 is apertured diminishes axially. Each of the apertures 32 may have a diameter of 0.5 to 3.0 mm and communicates with an air chamber 33 which receives a supply of air at a small pressure (e.g. a few centimeteres of water gauge) from a fan 34 *via* a pipe 35. The output of the fan 34 can be controlled by an iris control member 36.

The pressure of the air in the air chamber 33 is such that jets of air issue through the apertures 32 at substantially 90° to the respective walls 30, 31 of the inlet portion 15, the exit velocity of the air jets from the apertures 32 being in the range 40 to 120 metres per second. The air jets from the apertures 32 centralise and fluidise the peas 10 passing through the inlet portion 15 and thus effect substantial axial alignment thereof while preventing or reducing contact between the peas 10 and the walls 30, 31.

The said exit velocity may if desired be adjusted, by adjusting the iris control member 36, to cater for the particular product which is being fed.

The main portion 18, which extends throughout the major part of the axial length of the chute 16, is of substantially uniform cross-section throughout its axial length and is unapertured, although it may if desired have a very few apertures for receiving a supply of fluidising air (not shown). The main portion 18 has flanges 37 for connecting the main portion to support structure (not shown). The main portion 18 receives the substantially axially aligned peas 10 from the inlet portion 15 and accelerates them to space them from each other so as to supply them one at a time to the optical inspection area 21.

It should, however, be understood that although the portion 18 is shown and is described above as extending throughout the major part of the chute 16, and thus as being longer than the inlet portion 15, this is not essential.

The inlet end of a dust extractor pipe 40 is disposed adjacent to the inlet portion 15, the dust extractor pipe extending to a suction-operated dust extractor device 41.

In operation, the peas 10 which are supplied to the inlet portion 15 are acted on by the air jets issuing through the apertures 32 so as to be blown by the latter towards the centre of the inlet portion 15 whereby a single file of peas 10 is produced. Moreoever, the blowing of the peas 10 away from the walls 30, 31, helps to prevent deterioration of the surface of these walls by impact or abrasion. The air jets also have a fluidising effect on the peas 10 which assist axial alignment of the latter.

The air jets, moreover, remove dust and grit from the peas 10 and from the walls 30, 31 and prevent dust from settling on these walls, so that the abrasive effect of any peas 10 which do actually contact the walls is much reduced.

The cleaning effect of the air jets is much more efficient than that of a general draught of air, even if this draught is constituted by a larger volume of air than that provided by the jets. This is presumably because the relatively high air velocity blasts small particles off the surface of the peas 10.

Above all, the shape of the inlet portion 15, the positioning of the apertures 32, and the flow of air closely over the walls 30, 31, due to the Coanda effect ensures speedy individual separation of the peas 10 and their alignment down the chute before actual contact with the chute occurs in the main portion 18. The extra speed of the peas 10 through the inlet portion 15 is so produced eliminates the tendency of the peas 10 to roll and thus produces a stable feed. Furthermore, the said flow of air tends to cause the peas 10 pasing through the inlet potion 15 to become aligned with the bottom wall 31 and thus to be aligned at the same angle as the latter to the horizontal.

Since the air is passed through the apertures 32 at 90° to the respective walls 30, 31, the Coanda effect will ensure that each pea 10 gets good all round cleaning, any dust or dirt so removed being removed from the top of the chute 16 by suction developed by the dust extractor device 41. This is in contrast to a normal fluidised bed which uses a larger volume of air, such larger volume not only being more expensive to produce than the air jets from the apertures 32 but also being such as would be disturbed by the provision of the said suction developed by the dust extractor device 41.

The tapering shape of the inlet portion 15, together with the provision of the said air jets, funnels the peas 10 into a single file of peas by the time that they reach the upper end of the main portion 18. The latter, however, is of substantially uniform cross-section throughout its axial length since it is sized to accommodate the passage therethrough of a substantially single row of peas.

The peas 10 may be substantially in contact with each other at the upper end of the main portion 18. However, due to the acceleration under gravity of the peas passing through the main portion 18, the peas are spaced from each other by desired spaces by the time that they reach the optical inspection area 21, which is necessary if accurate sorting is to be achieved.

The main portion 18 is not apertured to provide air jets therethrough since this is not necessary and

could be disadvantageous. That is to say, the peas would have reached an adequate velocity by the time they entered the upper end of the main portion 18 to make it unnecessary to increase the velocity further by fluidising them. Furthermore, any dust settling in the main portion 18 would tend to be cleaned away by the travel of the peas at high velocity thereover, so that an air supply to remove such dust would not be necessary. If, indeed, the apertures were provided in the main portion 18 and these became clogged, the dust could cause serious discrepancies in the feed, and could even cause bunching and bouncing.

It will thus be appreciated that the invention provides a chute of simple and inexpensive construction which will ensure proper feeding of the commodity being sorted without the need for frequent use of a friction-reducing spray.

CLAIMS

1. A chute having an inlet portion to which a plurality of objects or particles may be supplied, the inlet portion tapering axially towards a portion whose cross-section is substantially uniform throughout its axial length, the inlet portion having apertures therein through which may be directed fluid jets to centralise and fluidise objects or particles passing through the inlet portion and thus effect substantial axial alignment thereof, and the substantially uniform cross-section portion in operation accelerating these substantially axially aligned objects or particles to space them from each other and thus supply them substantially one at a time to a point of use.

2. A chute as claimed in claim 1 in which the substantially uniform cross-section portion is unapertured or substantially unapertured.

3. A chute as claimed in claim 1 or 2 in which the substantially uniform cross-section portion extends throughout the major part of the axial length of the chute.

4. A chute as claimed in any preceding claim in which the substantially uniform cross-section portion extends to the outlet end of the chute.

5. A chute as claimed in any preceding claim in which the inlet portion merges into and is integral with the substantially uniform cross-section portion.

6. A chute as claimed in any preceding claim in which the side walls and bottom wall of the inlet portion are apertured so that the air jets therethrough prevent or reduce contact between the objects or particles and said walls.

7. A chute as claimed in claim 6 in which the majority of the apertures are in the side walls.

8. A chute as claimed in any preceding claim in which the extent to which the inlet portion is apertured diminishes axially towards the substantially uniform cross-section portion.

9. A chute as claimed in any preceding claim in combination with fluid pressure supply means for supplying said apertures with fluid pressure.

10. A chute as claimed in claim 9 in which the fluid pressure supply means supplies said apertures with fluid pressure to produce jets whose exit velocity from the apertures is in the range 40 to 120 metres per second.

11. A chute as claimed in claim 9 or 10 in which the fluid pressure supply means produces jets which issue at substantially 90° to the respective walls of the inlet portion.

12. A chute as claimed in any preceding claim comprising means for maintaining the chute at an angle of at least 45° to the horizontal.

13. A chute as claimed in any preceding claim in which the chute is arranged between a feed member and an optical inspection member of a light-sensitive sorting machine.

14. A chute substantially as hereinbefore described with reference to and as shown in the accompaanying drawings.

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